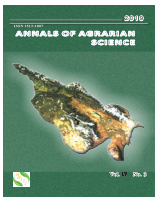
Annals of Agrarian Science

Journal homepage: http://journals.org.ge/index.php



To study population polymorphism in animals (Population mechanisms of adaptation to the environment)

G. Kajaia*

Patriarchate of Georgia, Saint King Tamar University; 68, D. Uznadze Str., Tbilisi, 0102, Georgia

Received: 29 January 2021, Accepted: 30 March 2021

A B S T R A C T

As known, animals have many ways to adapt to the environment, one of which is based on intrapopulation heterogeneity, or polymorphism. It ensures an adequate transformation of the demographic structure of the population during any changes in the environment. In the paper, against the background of the general characteristics of animal populations, the population polymorphism of one of the representatives of the Acaroidea mites is described. Our findings are based on observations made at the end of the last century on the Mugan Plain, near the city of Salyan (Azerbaijan) and in Shirak, on the Eldar Valley, while studying the holes of the Microtus.

Keywords: Population, Polymorphism, Stacia, Homeostasis, Ontogeny, Homeomorphic (males).

*Corresponding author Kajaia Gia; E-mail address: bell7779@mail.ru

Introduction

Species are known to be unevenly distributed within their area, and usually their members form more or less separate groupings - populations. According to the modern view, population is the basic form of existence of a species, i.e. a group of individuals of one species, which occupies a certain area and has the ability to exist indefinitely for a long time. Its members copulate freely with each other and are usually spatially isolated from other populations of the same species.

The species exists in the form of populations. In any biocenosis it is represented by population. In this sense, population can be considered as part of biocenosis, and biocenosis - as a combination of different species of populations.

Any organism, especially if it reproduces sexually, is a member of this or that population. Its long existence without population is difficult, often impossible. Members of the population are interrelated in many ways. Because of this, the population functions as a unified system [1].

No matter how homogeneous the species area is, not even two points can be found in it, with absolutely identical living conditions. This means that the action of natural selection is always different here. As populations are the result of long-term natural selection, each of them is more or less different from the others in a number of ways.

The population functions as a unified system, although this does not mean that it is homogeneous. Most populations are characterized by a complex structure. But intrapopulation units, unlike populations, do not spatially exclude each other and are more or less closely related. P o l y m o r p h i s m means the existence of two or more morpho-physiologically different forms within a population.

Polymorphism is an adaptive feature; it significantly increases the vital capacity of the population and contributes to the existence of the species under changing conditions. The more pronounced the

polymorphism, the wider the ecological plasticity of the population, the more easily it adapts to cyclical and sudden changes in the environment.

One of the manifestations of intrapopulation heterogeneity is the demographic structure of the population. It refers to the ratio of individuals of different ages and genders, which determines the birth rate, mortality rate and, ultimately, the change in population number over time. Examples of polymorphisms are castes - in public insects, seasonal races - in fish, races by location - in insects and rodents, etc. There are morphs that serve to transfer unfavorable environmental factors.

Deterioration of living conditions (drought, severe frosts, food shortages) is accompanied by a sharp decline in the number of animals, but this rarely affects the ability of the population to selfrecover. At the expense of individuals (morphs) resistant to extreme conditions, the optimal structure of the population is easily restored at the appropriate time [2, 3].

Any form of polymorphism should be considered as variants of genetic heterogeneity because they are genetically determined.

As A. Yablokov notes that "intrapopulation forms of animals (fast-growing, born in spring or early summer, rapidly reproducing, overwintering, etc.) provide high population polymorphism, thus accurately enhancing animal resilience to environmental variability" [4]. In the following years V. Bolshakov and L. Dobrinsky wrote: According to biologically important traits, any population is heterogeneous, which helps it to adapt to fluctuations in environmental conditions through genetic and ecological transformations [5].

The study of polymorphism is one of the priority areas of population ecology today. Undoubtedly, it has not only theoretical but also great practical significance, because it can be used to solve some issues of conservation biology - this topical field of science.

The study of animal population polymorphism began in the 60s of the last century. The object of study is mainly representatives of higher animals. In other animals this phenomenon is relatively poorly studied.

Main content

At the end of the last century we were able to detect a peculiar reveal of a polymorphism in one of the representatives of the type Arthropoda. The observations were made on the Mugan Plain (Azerbaijan), where the biology of Acaroids in extreme conditions has been studied for years. Dominant species was the Phizoglyphus echinopus F. et. R. The Microtus were being studied - the only place for these animals to exist in the mentioned region. The extraction and processing of material (content of holes) was carried out by the traditional method [6]. We used a field thermoeclectors.

The Phizoglyphus echinopus F. et. R. (family of the Acaridae) is a cosmopolitan species; Known as a pest of storage products, primarily bulbs, tubers, medicines, grains and its processing products. It is, at the same time, widespread in natural stacias. Inhabits in the holes of the warmblood animals, in the nests of ants, where it reproduces smoothly throughout the year.

The *Rh. echinopus* - is one of the most widespread species in the South Caucasus (Georgia, Armenia, Azerbaijan). It is found in all natural belts - from semi-deserts and fields to subalpine meadows, both in synanthropic conditions and in nature. Prefers high moisture substrates. The frequency of this species in Georgia is: 44% in synanthropic habitats and 56% in natural conditions. It is clearly characterized by high resistance to low temperatures [7-9].

The demographic structure of this species is noteworthy. Ontogenesis encompasses three stages. There are two types of males - the so-called. "Homeomorphic", which is identical in appearance to females, and "heteromorphic", which differs from females in a number of morphological features. Homeomorphic males are usually involved in breeding. The function of heteromorphic males is unknown until recently.

Over the years the demographic structure of the Rh. echinopus population during the summer months in the mentioned area was more or less stable. By average, it looked like this:

the share of females in the samples was 52-61%,

the share of males - 18-24% (of which heteromorphic males did not exceed 3%),

the share of underage forms - 32-41%.

A remarkable fact of drastic structural change in the *Rh. echinopus* population was observed in July 1981. In the first decade of this month there was an unusual drought in

the area. The number of the *Rh. echinopus* population has decreased by almost 5.5 times compared to the summer months of other years. About 95% in the samples were heteromorphic males and females, in approximately equal numbers.

In mid-July, we again analyzed the holes of the Microtus. The result was similar: against the background of a small number of organisms, a large part of the population was still heteromorphic males and females.

In mid-September we were again given the opportunity to study the demographic structure of the Mugan population. This time a large part of the population was represented only in underage forms. The share of adult organisms did not exceed a few percent. There was noted the copulation process.

In the summer of 1990 we again discover the *Rh. Echinopus* population - this time on the Eldar Valley, in the holes of the public Microtus. The number of the population did not exceed three dozen (on the traditional sample), of which about 50% were heteromorphic males, more than 20% - females, and the rest of the population were homeomorphic males and underage forms.

Unfortunately, we were not able to detect a similar change in the Rh. echinopus population in other regions of the South Caucasus. Therefore we have to draw conclusions based only on the unit populations described here. We suppose that the only reason for such a drastic change in the Mugan population is a substantial change in the microclimate at its particular location. The multiple increase in the share of heteromorphic males suggests that they take on the function of painlessly endure unfavorable living conditions by the population. The same can be said for females found with heteromorphic males in populations. There is no doubt that the ability to endure unfavorable conditions painlessly is their inherited determinant feature, which ultimately serves to save the population.

We had similar occurrence in the case of the Rh. echinopus' Eldar population.

It should be noted that the heteromorphic males described here are not only typical for Rh. echinopus. It is noticed in other representatives of the Acaroidea superfamily, namely, in the genera: Acotyledon, Caloglyphus, Schwiebea, etc., although whether they perform the same function as in the species described here is difficult to say [10]. In some representatives of the superfamily Acaroidea, peculiar dimorphism is also observed in underage forms. In many species (genera Acarus, Histiogaster, Mycetoglyphus, etc.) between stages I and III of individual development, two types of different structures are involved, of which I - serves to locate the species, and the function of II is often unknown. Thus we can assume that polymorphism is a much more common phenomenon than is confirmed by established facts.

Conclusion

As we can see, *Rh. echinopus* heteromorphic male is an essential element of the population (morpha), which serves to save the population during adverse changes in the environment. But after the environment stabilizes, they intensively copulate with the remaining females, after which the population returns to its optimal size and structure.

References

[1] Kajaia G., Animal Population Ecology, Tbilisi State University Publishing House, Tbilisi, 1990 (in Georgian).
[2] Eliava Ir., Nakhutsrishvili G., Kajaia G., Ecology, Publishing House of the Georgian National Academy of Sciences, Tbilisi, 2018 (in Georgian).
[3] Kajaia G., Contemporary Issues of Ecology, Publishing House of the Georgian National Academy of Sciences, Tbilisi, 2020 (in Georgian).
[4] Yablokov A.V. Population Biology. Publishing House "High School", Moscow, 1997 (in Russian).
[5] Bolshakov V.N. (ed.), Academician S.S. Schwartz, Digest of articles, Yekaterinburg, (in Russian).
[6] Kajaia G., Ecologic – morphological analysis of the Caucasian Acaridae, "Metsniereba", Tbilisi, 1975 (in Russian).
[7] Kajaia G.Sh., Fauna of harmful acaroids of Transcaucasia, Tbilisi, 1970 (in Russian).

[8] Kajaia G.Sh., Some Datum of Study of Mites Associated with Stored Food Products (Acaroidea) in South Caucasus Countries, Annals of Agrarian Science, Vol. 3, No 2 (2005) 113-117 (in Russian).
[9] Kajaia G. Sh., Comparative ecological-faunistical analyses of harmful mites of Armenia and Georgia, Biol. Journal of Armenia, LX1, 4 (2009) 47-49 (in Russian).
[10] Zakhvatkin A.A., Tyroglyphoid mites, Fauna of the USSR, Arachnids 6/1, 1941 (in Russian).